

CLAIMS

1. A lighting device for a high-pressure discharge lamp comprising:

5 a lighting circuit for controlling at least one of voltage and current fed from an external power supply to the high-pressure discharge lamp so as to turn on the high-pressure discharge lamp;

10 an igniter circuit for applying start-up high-voltage pulses to the high-pressure discharge lamp;

a turn on detection circuit for detecting the lamp turn on;

15 a first timer which permits igniter circuit operation for a predetermined period if the high-pressure discharge lamp is not turned on;

a second timer which activates the first timer at a predetermined intermittent time interval repetitively; and

20 a third timer which counts the time elapsed for restarting the high-pressure discharge lamp, and prohibits the operation of the igniter circuit after predetermined restarting time had reached.

2. The lighting device according to claim 1 further comprising:

25 a fourth timer which counts a total time in which the

high-voltage pulses are applied from the igniter circuit to the high-pressure discharge lamp according to respective operations of the first and second timers; and

5 a fifth timer which, in place of the second timer, activates the first timer at a predetermined intermittent time interval greater than said time interval of the second timer repetitively, after the total time counted by the fourth timer exceeds a predetermined time.

10 3. The lighting device according to claim 1 further comprising:

 a sixth timer which permits igniter circuit operation within said predetermined period of the first timer; and

15 a seventh timer which activates the sixth timer at a predetermined intermittent time interval repetitively.

4. The lighting device according to claim 1, wherein said predetermined period of the first timer and said time interval of the second timer are set in such a manner that
20 output voltage of the lighting circuit in a non-lighted state of the high-pressure discharge lamp has an effective value less than a predetermined value.

5. The lighting device according to claim 3, wherein said predetermined period of the first timer and said time

interval of the second timer are set in such a manner as to prevent overload beyond a maximum rating of a circuit component constituting the lighting circuit, the igniter circuit, the turn on detection circuit or the first to 5 seventh timers when the high-pressure discharge lamp is not turned on.

6. The lighting device according to claim 5, wherein the maximum rating of the circuit component is at least one of 10 a temperature rating, a current rating, a voltage rating and a power rating of said circuit component.

7. The lighting device according to claim 1, wherein each 15 of the first and second timers consists of an automatic reset-type temperature responsive switch adapted to open and close contact in response to temperature.

8. The lighting device according to claim 1, wherein said predetermined period of the first timer just after 20 initiation of the operation of the igniter circuit is set at a relatively large value.

9. The lighting device according to claim 8, wherein said predetermined period of the first timer just after 25 initiation of the operation of the igniter circuit is set

at a time sufficient for start-up of the high-pressure discharge lamp.

10. The lighting device according to claim 1, wherein said
5 predetermined period of the first timer and said time interval of the second timer are set in such a manner as to prevent an intra-outer-tube discharge from occurring in the high-pressure discharge lamp.

10 11. The lighting device according to claim 1, wherein the lighting circuit consists of a copper-iron ballast.

12. The lighting device according to claim 11, wherein the igniter circuit outputs a single high-voltage pulse around
15 a peak of an AC power supply voltage fed from the external power supply to the lighting circuit.

13. The lighting device according to claim 1, wherein the lighting circuit consists of an electronic ballast.

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14. The lighting device according to claim 13, wherein the lighting circuit outputs a rectangular-wave alternating current, and the igniter circuit superimposes the start-up high-voltage pulses on an output rectangular-wave voltage
25 from the lighting circuit.

15. The lighting device according to claim 14, wherein the
igniter circuit superimposes a single one of the high-
voltage pulses one time per one-half cycle of the output
5 rectangular-wave voltage.

16. The lighting device according to claim 15, wherein,
given that the one-half cycle of the output rectangular-
wave voltage is divided into an initial-half stage and a
10 last-half stage, the igniter circuit superimposes the
single high-voltage pulse in the initial-half stage.

17. The lighting device according to claim 16, wherein the
igniter circuit superimposes the single high-voltage pulse
15 just after a polarity of the output rectangular-wave
voltage is reversed.

18. The lighting device according to claim 13, wherein the
igniter circuit generates the high-voltage pulses through
20 the use of a resonance voltage.

19. The lighting device according to claim 1, which is
designed such that a power is supplied from the lighting
circuit to the high-pressure discharge lamp through a cable
25 which comprises a plurality of electric wires each composed

of a conductor having a thickness of 1 mm or less and an insulator covering the conductor, and a sheath having an insulting performance and covering the electric wires, wherein:

5 the lighting circuit outputs a rectangular-wave voltage alternating at a low frequency of several ten to several hundred Hz; and

10 the igniter circuit superimposes a high-voltage pulse of 3 to 5 kV on the rectangular-wave output voltage from the lighting circuit.

20. The lighting device according to claim 1, wherein:

 the high-pressure discharge lamp has a rated lamp power of 35 to 75 W;

15 said predetermined period of the first timer is set in the range of 3 to 5 seconds; and

 said time interval of the second timer is set in the range of 1 to 3 seconds.

20 21. The lighting device according to claim 1, wherein:

 the high-pressure discharge lamp has a rated lamp power of 150 W;

 said predetermined period of the first timer is set in the range of 0.5 to 1.5 seconds; and

25 said time interval of the second timer is set in the

range of 1 to 3 seconds.

22. A lighting apparatus comprising:

the lighting device according to any one of claims 1
5 to 21;

a case for housing the lighting circuit and the
igniter circuit;

a socket adapted to mechanically connected to a base
of the high-pressure discharge lamp;

10 a lamp fitting including a reflector for reflecting
light to be emitted from the high-pressure discharge lamp;
and

15 a cable including a plurality of electric wires each
covered by an insulator, and a sheath having an insulting
performance and covering the electric wires,

wherein the lighting circuit and the igniter circuit
are electrically connected to the socket through said cable.